

WHAT IS CLAIMED IS:

1 1. A crystalline silicon thin film semiconductor device
2 comprising:

3 a conductive substrate or a substrate having on its
4 surface a conductive layer;

5 a crystallographically oriented first polycrystalline
6 silicon layer which has been formed by introducing a metal
7 catalyst element into an amorphous silicon layer, formed on the
8 surface of the conductive substrate or the conductive layer, or
9 so as to come into contact with the surface portion of the
10 amorphous silicon layer, and heat treating the amorphous
11 silicon layer to crystallize the amorphous silicon layer; and

12 a second polycrystalline silicon layer which has been
13 formed, using the first polycrystalline silicon layer as a seed
14 crystal, so as to have the same conductivity type as the first
15 polycrystalline silicon layer.

1 2. The crystalline silicon thin film semiconductor device
2 according to claim 1, wherein the second polycrystalline
3 silicon layer contains not less than 0.1% of hydrogen.

1 3. The crystalline silicon thin film semiconductor device
2 according to claim 1, wherein the second polycrystalline
3 silicon layer is crystallographically oriented in the
4 thicknesswise direction.

1 4. The crystalline silicon thin film semiconductor device
2 according to claim 1, wherein the second polycrystalline
3 silicon layer has the same crystallographic orientation as the
4 first polycrystalline silicon layer.

1 5. The crystalline silicon thin film semiconductor device
2 according to claim 1, which further comprises, provided on the
3 second polycrystalline silicon layer in its side remote from
4 the first polycrystalline silicon layer, a third
5 polycrystalline silicon layer of a second conductivity type
6 which is different from the conductivity type of the second
7 polycrystalline silicon layer.

1 6. The crystalline silicon thin film semiconductor device
2 according to claim 5, which further comprises, provided between
3 the third polycrystalline silicon layer and the second
4 polycrystalline silicon layer, a fourth polycrystalline silicon
5 layer of a third conductivity type which is different from the
6 conductivity type of the second polycrystalline silicon layer
7 and the conductivity type of the third polycrystalline silicon
8 layer.

1 7. The crystalline silicon thin film semiconductor device
2 according to claim 5, wherein the third polycrystalline silicon
3 layer has the same crystallographic orientation as the second
4 polycrystalline silicon layer.

1 8. The crystalline silicon thin film semiconductor device

SUB
C.17

09925626 "081001"

2 according to claim 6, wherein the fourth polycrystalline
 3 silicon layer has the same crystallographic orientation as the
 4 second polycrystalline silicon layer.

1 9. The crystalline silicon thin film semiconductor device
 2 according to claim 6 or 8, wherein the fourth polycrystalline
 3 silicon layer has the same crystallographic orientation as the
 4 third polycrystalline silicon layer.

sub
 10. The crystalline silicon thin film semiconductor
 device according to claim 5 or 6, wherein the third and fourth
 polycrystalline silicon layers contain not less than 0.1% of
 hydrogen.

11. A crystalline silicon thin film photovoltaic device
 comprising:

a conductive substrate or an insulating substrate having
 on its surface a conductive layer;

a first polycrystalline silicon layer of a first
 conductivity type which has been formed by introducing a metal
 catalyst element into an amorphous silicon layer, formed on the
 surface of the conductive substrate or the conductive layer, or
 so as to come into contact with the surface portion of the
 amorphous silicon layer, and heat treating the amorphous
 silicon layer to crystallize the amorphous silicon layer;

a second polycrystalline silicon layer which has been
 formed, using the first polycrystalline silicon layer as a seed
 crystal, so as to have the same conductivity type as the first

15 conductivity type;

16 a substantially i-type third polycrystalline silicon
17 layer provided on the second polycrystalline silicon layer;

18 a fourth polycrystalline silicon layer that is provided
19 on the third polycrystalline silicon layer and is of a second
20 conductivity type which is different from the first
21 conductivity type; and

22 an electrode part provided on the fourth polycrystalline
23 silicon layer.

09/12/2009 09:10:07
c7 12. The crystalline silicon thin film photovoltaic device
according to claim 11, wherein
the conductive substrate is stainless steel; and
the substrate having on its surface a conductive layer is
glass.

13. A crystalline silicon thin film photovoltaic device
comprising:

an insulating substrate having on its surface an
electrode;

a first polycrystalline silicon layer of a first
conductivity type which has been formed by introducing a metal
catalyst element into an amorphous silicon layer, formed on the
electrode of the insulating substrate, or so as to come into
contact with the surface portion of the amorphous silicon layer,
and heat treating the amorphous silicon layer to crystallize
the amorphous silicon layer;

a second polycrystalline silicon layer which has been

13 formed, using the first polycrystalline silicon layer as a seed
 14 crystal, so as to have the same conductivity type as the first
 15 conductivity type;

16 a third polycrystalline silicon layer which is provided
 17 on the second polycrystalline silicon layer and is of a second
 18 conductivity type which is different from the first
 19 conductivity type; and

20 an electrode part provided on the third polycrystalline
 21 silicon layer.

14. A process for producing a crystalline silicon thin
 film semiconductor device, comprising the steps of:

providing a conductive substrate or a substrate having on
 its surface a conductive layer and forming an amorphous silicon
 thin film on the surface of the conductive substrate or the
 surface of the conductive layer in the substrate;

introducing a metal catalyst element into the amorphous
 silicon layer or so as to come into contact with the surface
 portion of the amorphous silicon layer, and heat treating the
 amorphous silicon layer to crystallize the amorphous silicon
 layer and to form a crystallographically oriented first
 polycrystalline silicon layer;

forming, on the first polycrystalline silicon layer, a
 second polycrystalline silicon layer, of the same conductivity
 type as the first polycrystalline silicon layer, using the
 first polycrystalline silicon layer as a seed crystal; and

forming, on the second polycrystalline silicon layer, a
 third polycrystalline silicon layer of a second conductivity

19 type which is different from the conductivity type of the
20 second polycrystalline silicon layer.

1 15. The process according to claim 14, wherein the
2 amorphous silicon layer contains not more than 0.3% of hydrogen.

1 16. The process according to claim 14 or 15, wherein the
2 amorphous silicon layer has a thickness of not more than 50 nm.
3

09925626 "081001
T00T80" 92952660